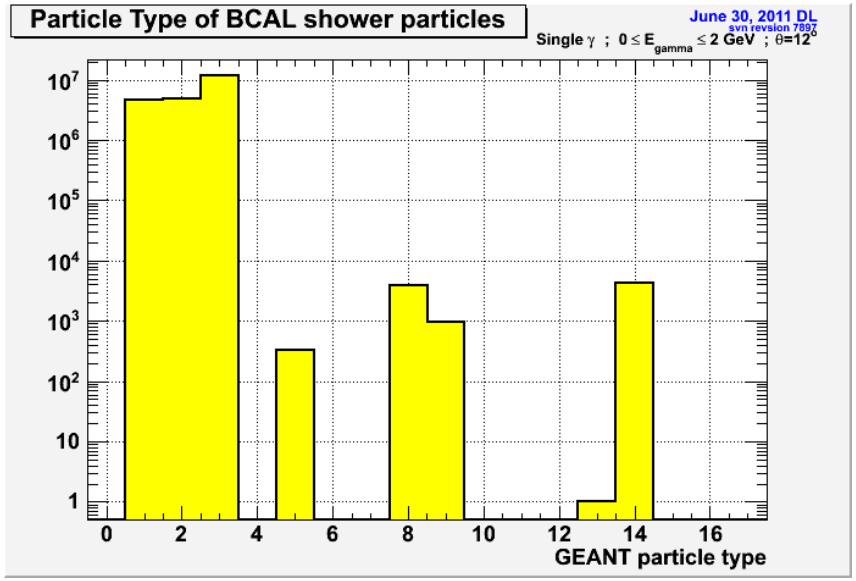
BCAL Signal Timing Distributions

David Lawrence JLab

June 30, 2011

Particle Type of BCAL shower particles

Particle types for steps depositing at least 100 kEV of energy

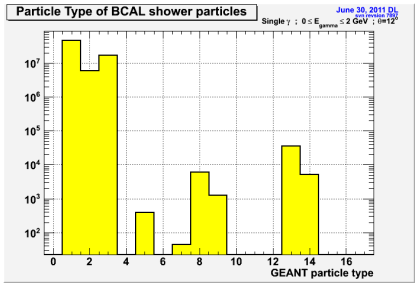


Hadrons contribute very little to the average shower

GEANT Particle IDs

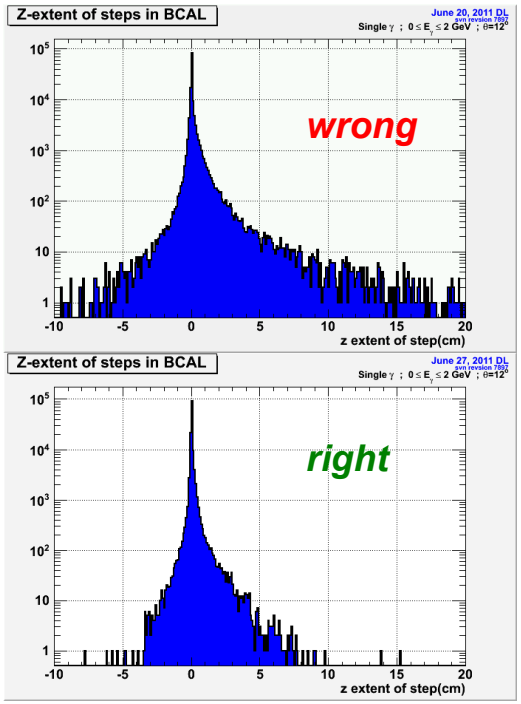
```
Unknown     =  0,
Gamma       =  1,
Positron    =  2,
Electron    =  3,
Neutrino    =  4,
MuonPlus    =  5,
MuonMinus   =  6,
Pi0         =  7,
PiPlus      =  8,
PiMinus     =  9,
KLong       = 10,
KPlus       = 11,
KMinus      = 12,
Neutron     = 13,
Proton      = 14,
AntiProton  = 15,
KShort      = 16,
Eta         = 17,
Lambda      = 18,
```

Types with no cut on deposited energy

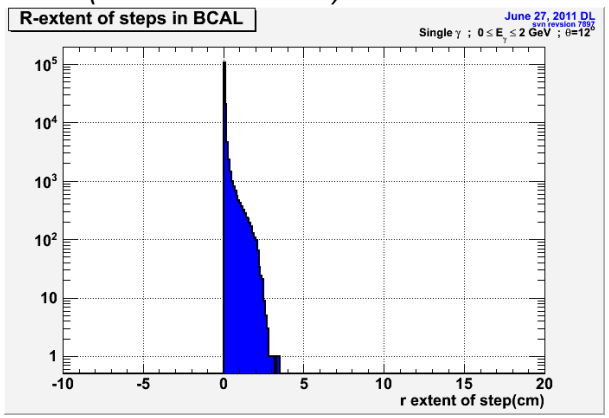


Step size in radial direction

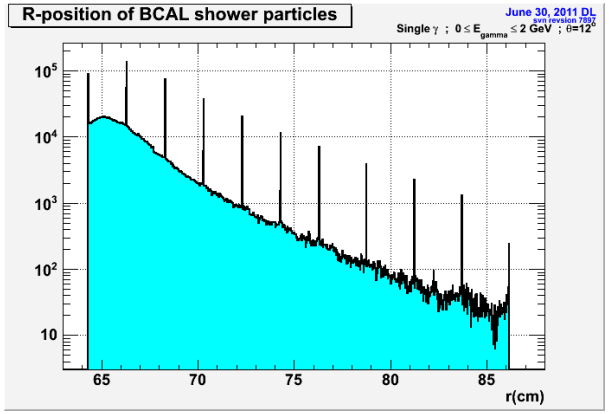
Correction: z-projection of steps shown last week were miscalculated indicating they were slightly larger than what they should have been



R-projection of steps is contained to cell size (2.0cm to ~3.4cm)

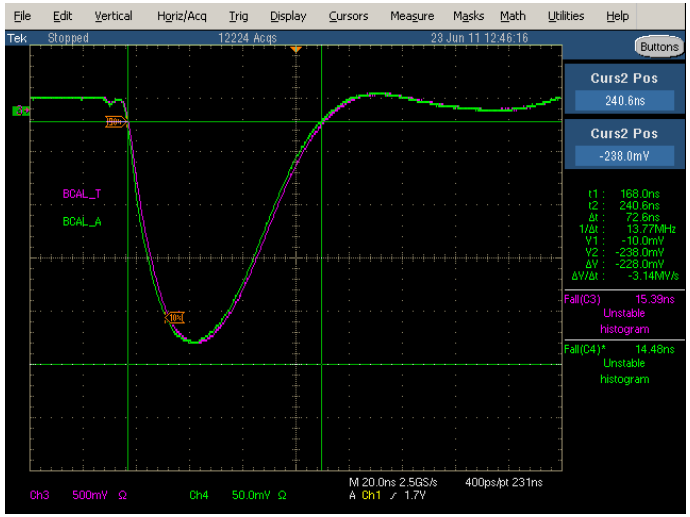


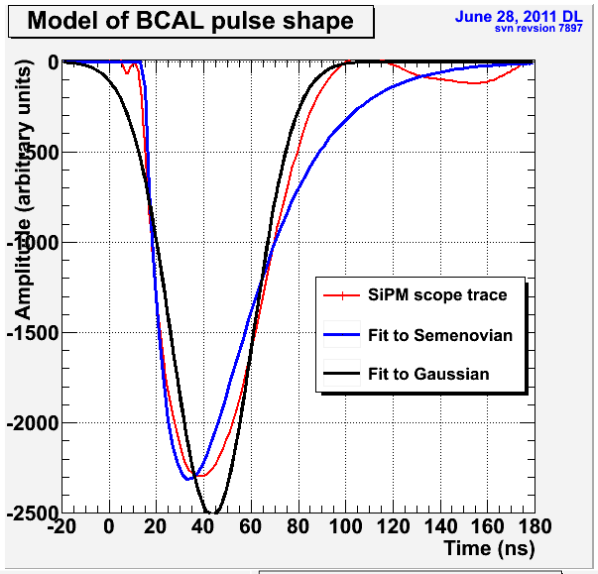
R-boundaries can be seen easily in step positions

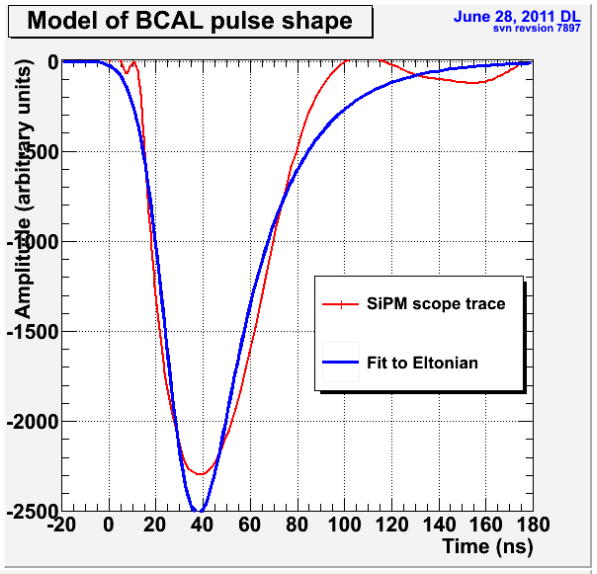


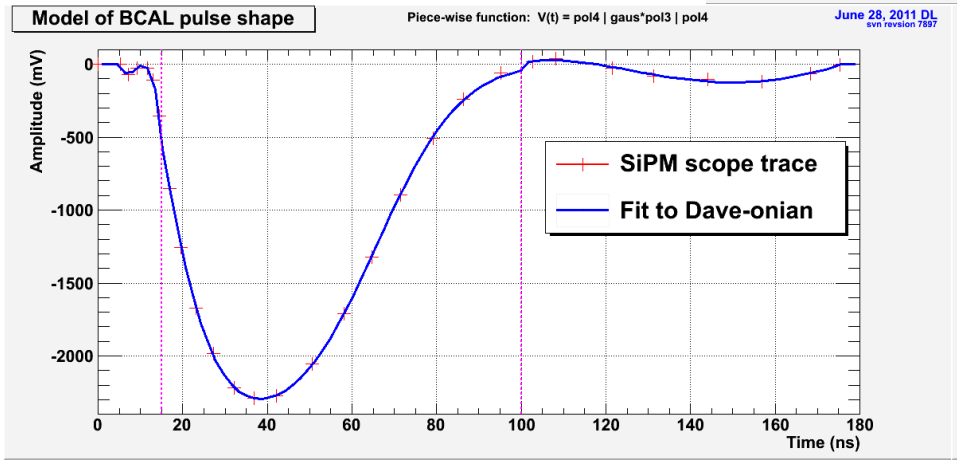
SiPM pulse shape

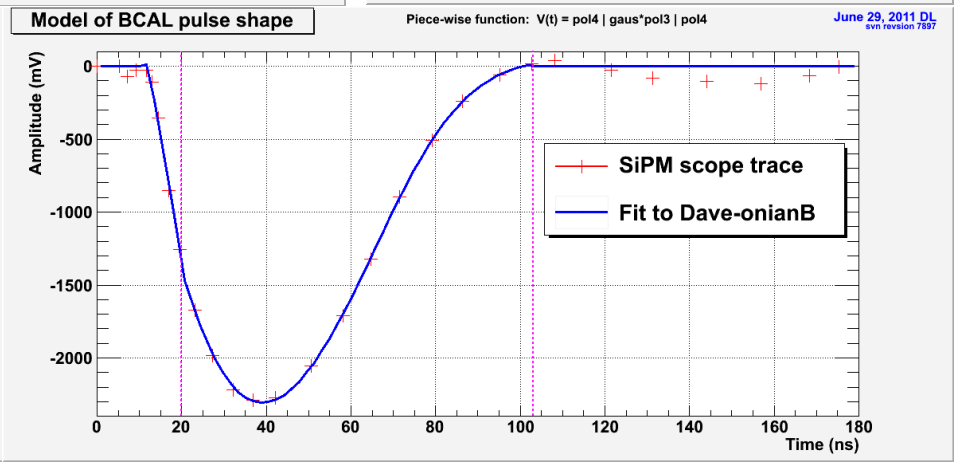
Fernando provided an image of a scope trace of a SiPM pulse. Several functional forms were used to try and fit the shape.
Eventually, one was used that cuts out both the pre and after pulses (bottom right)











Relating MeV to Signal Amplitude

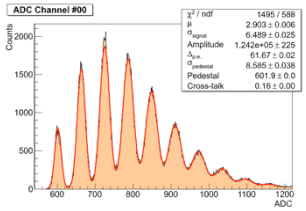
From CalibDB

75 photons/side/MeV in fiber
0.21 PDE
0.095 Sampling fraction

→ 0.668 MeV/PE

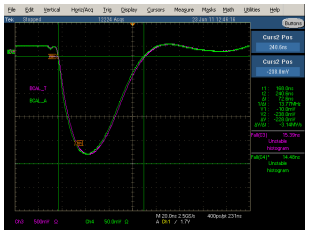
61.67 QCD counts/PE
CAEN V792 QCD: 100fC LSB

→ 9.23 pC/MeV



SiPM pulse shape:
1.20 nC for 2.293V peak

→ 17.6 mV/MeV



Discriminator Thresholds

Convert effective thresholds in MeV from June 2nd presentation to electronic thresholds in mV that can be applied to signal distributions.

Effective thresholds

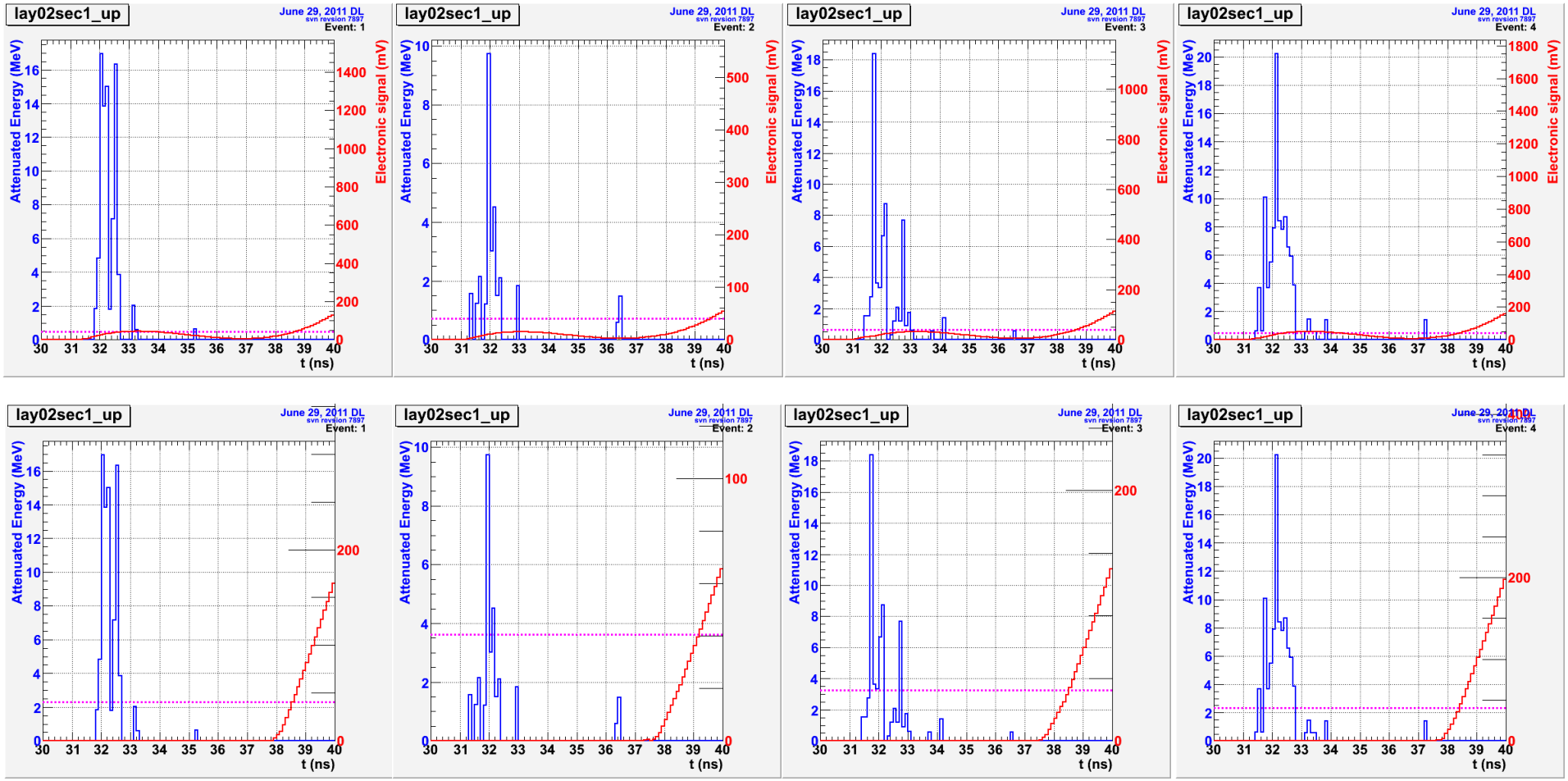
	inner	outer
fine (near)	2.3 MeV	2.3 MeV
fine (far)	8.4 MeV	8.4 MeV
course (near)	2.4 MeV	2.6 MeV
course (far)	8.8 MeV	9.5 MeV

from June 2nd presentation

	inner	outer
fine	40.5 mV	40.5 mV
course	42.2 mV	45.8 mV

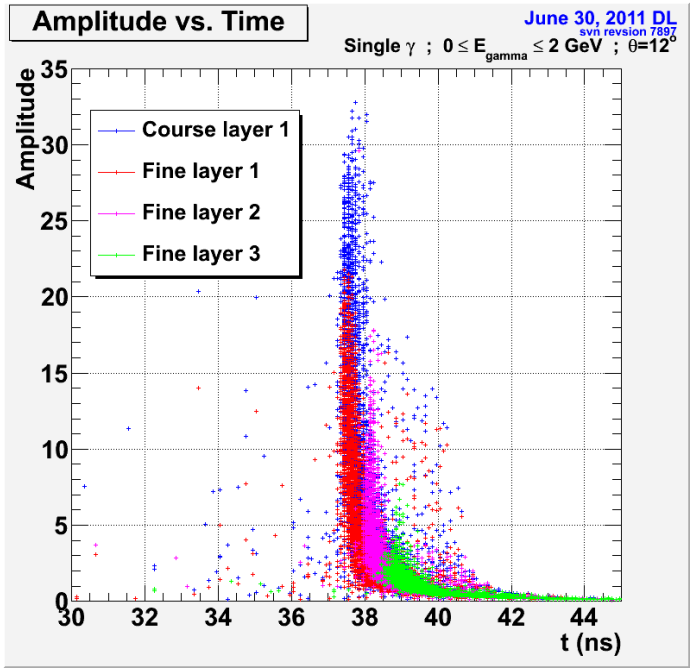
Applying Threshold

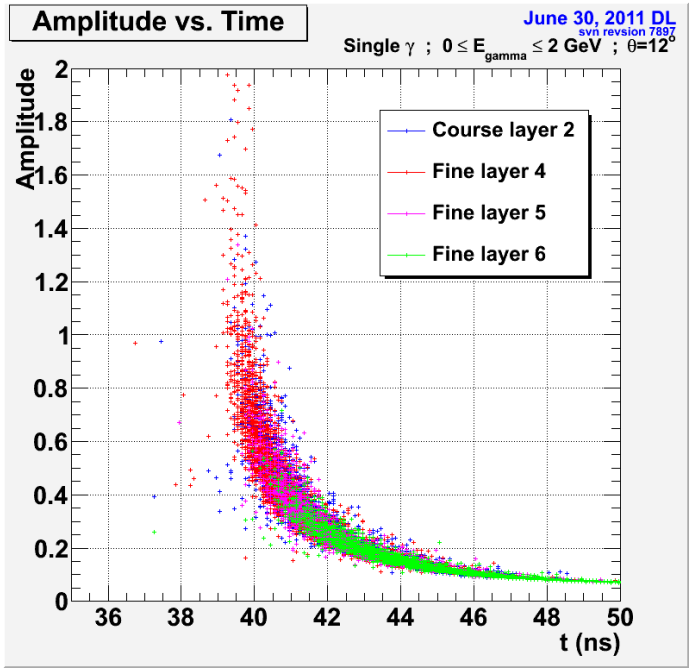
- Top plots include pre-pulse in pulse shape representation, bottom ones do not.
- Single cells shown for first 4 events (sampled from 0< E <2GeV @ 12^{o})
- Electronic signal is plotted vs. right axis.



Amplitude vs. Discriminator Time

Plots here are for one sector
Generated particles distributed evenly over ϕ





Still to Do …

- Add in Dark hits
- Improve leading edge of pulse shape?
- Timewalk correction
- Reconstruction to get shower position
  - Optimize TRMS in KLOE for both fine and course segmentation schemes

Realistically, these tasks will take 3-4 weeks minimum (+1 week due to my being on vacation next week). This would push segmentation decision back to first week of August at the earliest.

How to proceed?